

Understanding the knowledge, attitudes, and practices of vegetable production for improving household nutrition in Karatu District, Tanzania

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Through action research and development partnerships, Africa RISING is creating opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program’s monitoring, evaluation and impact assessment.

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# Abstract

Improved management practices (IMP) combined with technological packages of good quality improved seeds, healthy seedlings, and good agronomic practices (GAPs) are essential in vegetable farming for increased household income and for food and nutrition security. This study was conducted to understand the production of vegetables, dietary diversity and nutritional status of rural farmers in Karatu district in Tanzania as a way to establish research and training needs for improved vegetable production systems. A questionnaire-based survey was conducted in Karatu district with a total of 487 vegetable farmers. Common vegetables grown were tomato, onions, African Eggplant, Ethiopian Mustard, Chinese Cabbage and African nightshade. The main foods consumed by the households were cereals, spices, condiments and beverages, vegetables, oils and fats, sweets, legumes, nuts and seeds and fruits. Meat products (i.e. poultry, offal, fish, etc.), eggs, milk and milk products were rarely consumed by many households. Ninety percent of what was consumed was purchased. The average Household dietary diversity scores (HDDS) was 6.15 which means that on average, households consumed six food groups over the preceding 24-hours. Intervention households had higher dietary diversity score (p<0.01) than control households. 62% of the farmers knew that vegetables contain nutrients needed for growth and health while 38% did not know. Most farmers were not aware of the minimum requirement daily vegetable intake. About 26% of vegetable farmers perceived vegetable farming to be risky than cereal production, mainly because of dry nature of their areas, lack of a reliable market and persistent problem of pests and disease. The study recommends to the strategic development partners and project stakeholders to design interventions that will provide education especially on the nutritive value of vegetables and improved production practices for increased production of vegetables, improved health of household members and their communities and increase household income.

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# Background and justification

Sustainable and nutritious food productions are the major challenges for global food security especially in the developing countries. Dietary diversity needs and food variety are important for human health and an active population. Well-informed consumers are knowledgeable and aware of the importance of healthy diets and effectively communicate their preferences for food types, qualities and quantities through the food supply chain. The majority of the uninformed consumers are nutritionally vulnerable populations and depend upon agriculture as a key source of livelihood. Vulnerable groups know little about healthy diets and consume insufficient nutrient-rich foods leading to micronutrient deficiencies (Grebmer et al., 2014). The agriculture sector and wider agri-food system should be the central to sustained progress in reducing undernutrition. Sustainable and resilient food system should be one that offer consumers with affordable and nutritious food choices.

Diets in developing country settings are more often deficient in multiple micronutrients rather than in single nutrients and/or energy (Allen et al., 2009). Moreover, the most affected groups are children under five, pregnant and lactating women. Malnutrition in all its forms is one of the key constraints to human health (IFPRI 2016) and has a strong negative impact on the development of different community members, especially children under five years. Under-nutrition includes stunting (low-height-for- age), wasting (low-weight-for-height), underweight (low-weight-for-age) and micronutrient deficiencies (Black et al., 2013) and has been used as an indicator to measure the development of a nation (Black et al., 2013, Badake et al., 2014) as it reflects how the most vulnerable are treated. Different goals and strategies have been set at different times with the purpose of improving the status of child nutrition ((WHO, 2013).

The prevalence of stunting, underweight and wasting varies by region and sub-region in most low-income countries. For example, South Asia and sub-Saharan Africa were reported as the most affected regions. South Asia (33%), followed by sub-Saharan Africa (21%), had the highest prevalence of underweight. In South Asia, the prevalence of stunting and wasting were 39% and 16% respectively while, in sub-Saharan Africa, the respective prevalence at 40% and 9% (Unicef, 2013). More than one-third of all under-five child deaths were attributable to undernutrition, with the majority of these occurring in low and middle-income countries (WHO, 2013). In Tanzania, 34.7% of all children under five years are stunted and 57% are anemic (NBS and Macro, 2015).

Undernutrition resulting from micronutrient deficiency is one of the most prevalent problems in the world, specifically in sub-Saharan African countries (Bhutta et al., 2013). Next to detrimental health effects through under nutrition there is also an emerging face of other burden of childhood overweight and obesity that results from over nutrition. In Tanzania, the ministry responsible for health in partnership with other organizations have implemented several interventions, such as education, on the importance of optimal breastfeeding, dietary diversity, and health education to reduce the problem of undernutrition. Previous research has shown that nutrition education, for example for mothers in improving the nutrition and health status of young children in areas where food is available, is effective (Lartey, 2008). Adults eating behavior varies with nutrition knowledge that explains the variations in their food choice (Wardle et al., 1999). Providing nutrition education enables households to make better production and consumption decisions (Njoro et al., 2013).

Smallholder farmers are also consumers of harvest they produce. Hence, improved knowledge about the post-harvest quality and nutritional significance of a high diversity of foods could therefore have an immediate impact on their livelihoods. In this context, Ochieng et al., (2016) found that households benefiting from traditional African vegetables (TAVs) promotion and demand creation activities had a significantly higher dietary diversity for children under five and women of reproductive age. The integration of dietary diversification with better postharvest management of common staples has the potential for stepping–up the improvements of household nutritional outcomes. The importance of dietary diversity to counteract malnutrition in all its forms in Sub-Saharan Africa is well acknowledged (e.g. Kennedy et al., 2007). Therefore, it is essential that different approaches to increase consumption of nutrient-rich foods are tested and if effective brought to scale. Among these, it is highly recommended to include smallholder farmers and emphasize on synergistic nutritional outcomes from food production, processing, marketing and consumption (FAO 2013; Gillespie et al., 2015). To increase male and female smallholders’ knowledge about the nutritional significance of the foods they produce, purchase and consume, the approach introduces nutrition education and communication strategies along the vegetable value chain.

This intervention will not only introduce different vegetable-based recipes but also encourage the households to eat nutritious and diverse diet for healthy living while also ensuring better postharvest management of harvested produce. It also aims at influencing key vegetable value chain actors such as government through the Ministry of Agriculture (MoA), Tanzania Agricultural Research Institute’s (TARI), Ministry of Health and Social Welfare (MOH&SW), and NGOs (RECODA, IDP, MVIWATA) towards implementing interventions that lead to positive nutrition outcomes, growing diverse and nutrient rich crops, off-season vegetable production, and implementing postharvest handling practices.

The baseline survey was conducted to understand the production of vegetables, dietary diversity and nutritional status of rural farmers in Karatu district, Tanzania. Findings from this study will create awareness among farmers and strategic developmental partners on the existing opportunities in vegetable production for improved income and nutritional security. Two districts (Babati and Karatu) are involved in the project with seventeen sampled villages in Karatu (Beneficiaries and Control villages). A total number of 487 respondents were interviewed. The survey involved individual interviews and focus group discussions (FGD) which were conducted to generate information on knowledge, attitudes and practices of people on the production of vegetables. The main objective is to increase vegetable production and consumption of diverse nutrient-rich foods by poor rural households in Tanzania.

# Study objectives

1. To estimate the impact of improved agricultural practices on yield and income from vegetables
2. To test uptake of nutritious recipes using model food kiosks/village restaurants
3. To estimate the impact of nutritional education on farmers nutritional knowledge, attitude and practices (KAP), income and household nutrition

**Participating organizations;** World Vegetable Centre (WorldVeg), IITA, IDP, RECODA, MVIWATA, Tanzania Agricultural Research Institute (TARI)-Tengeru.

# Methodology

The baseline survey was done in purposively selected intervention and control villages. The 17 intervention villages were purposively selected by development partner-IDP based on 6 criteria as follows; (1) The village must have very few development agencies working on sustainable farming; (2) Presence of sustainable organizations for synergies to avoid duplication of interventions; (3) At least each agro-ecological zone (AEZ) should be represented by the selected villages; (4) The village members should be supportive and local leaders accept intervention; (5) Active population density and land size for realizing targets; and (6) Potential for increasing production and productivity. The intervention approach allowed many farmers to participate in the research project.

First step to the survey involved sensitization meetings in the selected villages through focus group discussions (FGD) to understand the current knowledge, attitude and practices which was done parallel with baseline survey. FGD helps to document the current consumption patterns, which includes food diversity, preparations, nutrition challenges and role of men and women in improving household nutrition. Key informant interview (KII) was deployed to capture vegetable-based recipes currently being sold in the local restaurants/food kiosks and prepared by different households. These recipes include other locally available food.

## Sample size and data collection

Baseline survey was conducted with 17 intervention groups and 10 control groups in Karatu District, Tanzania. Data was collected from 487 farmers (236 project beneficiaries and 251 control) which is more than the number previously sampled based on the sample size calculation method proposed by Smith et al., (2005) below:



Where ‘n’ is the sample size and ‘P’ is the proportion of the population of interest, smallholder farmers growing vegetables including TAVs. P is 0.5, which statistically result into a sufficient and reliable size when the population proportion is unknown with certainty (Daniel et al, 1975). The variable ‘d’ is the significance level set at 5% to remove 95% bias in sampling resulting to ‘Z’ value of 1.96. Variable’ Q’ is the weighting variable and is computed as ‘1-P’. This calculation yields 385, which is approximated to 400 per country to conveniently meet the sampling procedure and non-response.

Farmers were randomly selected from each group proportionate to the size of the group. Group membership range from 15 to 30 members. Nutrition messaging will be delivered to farmers in the selected villages. Control villages will receive no nutrition messaging training intervention. At the end of the intervention an end line survey will be conducted in July 2021.

## Data Analysis

The production, dietary diversity, nutrition status and household consumption of vegetables were expounded by carrying out a descriptive analysis to establish frequencies, means, and percentages of collected interview data from sampled households. Content analysis was used to analyze data from FGD.

This study will collect two panels of data (baseline and end-line data). In the later stages, Difference in Difference (DiD) estimator will be used to assess smallholder farmers’ welfare impacts of nutrition education training supported by the Africa RISING project. The method is widely used to minimize selection bias with individual level panel data in impact evaluation studies.

The DiD estimator is defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the comparison group before and after treatment, thus becoming a proper counterfactual for the treatment group. DiD will be combined with propensity score matching (PSM) in order to obtain robust results and reach a reliable conclusion. The non-parametric propensity score matching method is used to estimate the effects of the treatment, which here refers to participation in the on-farm activities implemented under this project as well as to reduce bias in effect estimates. Propensity score matching and inverse probability weighting both start by regressing program placement (trained vs. untrained) on a set of independent farm and household characteristics that simultaneously influence program placement and outcomes.

## Plan for communicating findings of the study

The results of the study will be shared through a report and scientific publication in a peer-review journal. Other media avenues through which the results might be shared include publication in blog posts on the websites (e.g. Africa RISING wiki spaces, WorldVeg website), as well as through participation in different types of meetings such as inter-national scientific conferences and meetings at the Ministry of agriculture in the countries. These baseline results will be very useful for planning the implementations of the project, monitoring project progress and evaluation of the project.

## Ethical considerations

The respondents were informed about the objectives of the survey. Prior to starting each interview, the study objectives were explained to the respondents and the interviewees were explicitly asked for their verbal informed consent to voluntarily participate in the study. The consent was recorded in the questionnaire. Clarification was done by informing the respondents that the data collected would be kept strictly confidential, analyzed anonymously and will be used for research purposes only. Given that this study will use non-invasive approaches, no ethical approval was required from government organizations in the respective districts. However, approval to carry out the study in the respective district was obtained from District Executive Director (DED) in Tanzania. In addition, internal approval was obtained from World Vegetable Center’s Institutional Biosafety and Research Ethics Committee (IBREC).

# Results and discussion

## Socio economic characteristics of households

Out of the 487 sample farmers 62% were male while 83% belonged to male-headed households. 83% of these heads of households were married with children (Table 1). On average, households owned 5.96 acres (6 acres by beneficiaries; 5.8 acres for the control). Few households had access to either private or public extension service with only 24% having access to agricultural information and support. The situation is similar with regard to participation in agricultural training (31%). Households allocated on average about 0.181 acres to vegetable production and 46% of the households had home/kitchen garden for vegetables. There are no significant differences between beneficiaries and control thus these two groups can be used to estimate the impact of nutrition education.

**Table 1.** Basic characteristics of the sampled households.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (B) (n=236) | Control (C) (n= 251) | Total  (N=487) | Test (T=C) -p-value |
| Sex of respondent (= 1 if male) % | 58.05 | 66.93 | 62.63 | 0.043 |
| Sex of head of the HH (=1 if male) % | 87.29 | 92.43 | 89.94 | 0.059 |
| Marital status |  |  |  |  |
| 1=married (%) | 84.32 | 83.27 | 83.78 | 0.529 |
| 2=single (%) | 2.97 | 8.76 | 5.95 |  |
| 3=divorced (%) | 1.69 | 0.4 | 1.03 |  |
| 4=separated (%) | 3.81 | 1.99 | 2.87 |  |
| 5=widowed (%) | 7.2 | 5.58 | 6.37 |  |
| Household size (#) | 6.09 | 5.83 | 5.96 | 0.216 |
| Land owned (acres) | 2.077 | 2.330 | 2.208 | 0.403 |
| Land allocated to vegetables (acres) | 0.136 | 0.222 | 0.181 | 0.100 |
| Own vegetable home garden (1=yes) % | 51.71 | 40 | 45.66 | 0.010 |
| Access to extension services (yes) % | 27.97 | 20.32 | 24.020 | 0.058 |
| No. of times visited by extension officer | 1.416 | 0.997 | 1.200 | 0.175 |
| Participation in agriculture training (yes) | 39.83 | 23.51 | 31.42 | 0.000 |

## Vegetables grown

The most commonly grown vegetables in Karatu include Ethiopian mustard (27%), Chinese cabbage (17%), African nightshade (14%), onions (11%), tomato (9%) and pumpkin leaves (7%) (Table 2). Onions were mainly grown in control villages (16%) compared to beneficiaries’ households (6%). Traditional African vegetables (TAVs) such as Jute mallow, spider plant, okra and standard vegetables (sweet pepper and French beans) were nearly not grown in Karatu, providing a good opportunity to introduce them to farmers.

**Table 2.** List of vegetables grown by farmers in Karatu District.

|  |  |  |  |
| --- | --- | --- | --- |
| Vegetables | Beneficiaries (B) (n=236) | Control (C) (n= 251) | Total  ( N=487) |
| Ethiopia Mustard | 35% | 20% | 27% |
| Chinese cabbage | 19% | 16% | 17% |
| African Nightshade | 22% | 7% | 14% |
| Onions | 6% | 16% | 11% |
| Tomato | 15% | 4% | 9% |
| Pumpkin Leaves | 9% | 5% | 7% |
| Cowpea leaves | 7% | 2% | 4% |
| African Eggplant | 4% | 2% | 3% |
| Amaranth | 5% | 0% | 2% |
| Carrot | 0% | 2% | 1% |
| Sweet potato leaves | 0% | 1% | 1% |
| Cabbage | 1% | 1% | 1% |
| Jute mallow | 1% | 1% | 1% |
| Spider plant | 1% | 0% | 0% |
| Sweet pepper | 1% | 1% | 1% |
| Kales | 0% | 0% | 0% |
| Okra | 0% | 0% | 0% |
| French Beans | 0% | 1% | 0% |

## Production of vegetables

Table 3 shows the total vegetable production per household per season in Karatu. On average a household produced 861 kg of vegetables (mainly top 5 vegetables in Table 2) and 81% of the produce is sold. Post-harvest loss was very low at 4% because most of the farmers sell at the farm gate. However, yield, income, market participation and post-harvest losses varied by type of crop, See (Appendix 2, Table 3A-3E). It shows the variations among the most common cultivated vegetables in surveyed areas. There was no significant difference between beneficiaries and control in terms of production, sales and utilization indicators (Table 3 last column).

**Table 3.** Total vegetable production, sales, utilization and post-harvest losses.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (T=C) p-value |
| Yield (Kg) per household per season | 713.9 | 919.5 | 861.6 | 0.4746 |
| Home consumption (kg) | 50.3 | 32.62 | 41.2 | 0.0333 |
| Distributed to neighbors (kg) | 43.7 | 39.6 | 41.6 | 0.7793 |
| Post -harvest loss (kg) | 39.0 | 37.5 | 38.2 | 0.9566 |
| Quantity sold (kg) | 581.0 | 809.9 | 698.9 | 0.3996 |
| Market participation (% sold) | 81% | 81% | 81% |  |
| Postharvest loss (% lost) | 5% | 4% | 4% |  |

***Notes.*** Table combines all the vegetables produced per household per season.

## Nutrition knowledge, attitude and practices

Overall, 62% of the farmers knew that vegetables contain nutrients needed for growth and health while 38% did not know (Table 4). It is surprising that about 16% of farmers indicated that all vegetables have similar nutrients. Only 6% of the farmers correctly named vegetables that are high in iron. These findings show that farmers lack knowledge about the nutritional contents of vegetables and their health benefits. Although, 88% of them believe that it is important to eat vegetables everyday they are not aware of the minimum amount they should consume per day. To improve overall health, the World Health Organization (WHO) states that an individual should consume about 200 grams of vegetables (minimum of 400 grams of fruits and vegetables which is equivalent to five servings of 80 g each (World Health Organization, 2003). About 80% would like to increase vegetable consumption while 60% of the households indicated that they plan to increase vegetable consumption in their households. Generally, the consumption of vegetables in developing countries is in ranges from 20-50 % of the minimum recommended level, and this is largely attributed to poverty and food insecurity in developing countries (FAO, 2019).

**Table 4.** Assessment of farmers’ nutrition knowledge and attitude.

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control  (n= 251) | Total (N=487) |
| Do vegetables contain nutrients needed for growth and health? (1 if knows) | 68.64 | 55.78 | 62.01 |
| Do all vegetables have similar nutrient values (1 if yes)? | 20.76 | 11.95 | 16.22 |
| Correctly naming three vegetables that are high in vitamin A | 70.76 | 63.35 | 66.94 |
| Correctly naming three vegetables that are high in iron | 7.23 | 5.18 | 6.17 |
| Are you aware of how many grams of vegetables you should eat each day? | 31.36 | 6.77 | 18.69 |
| Is it important to eat vegetables every day? (1=yes) | 90.17 | 86.45 | 88.25 |
| Do you want to increase vegetable consumption by your family (if yes) | 84.75 | 78.88 | 81.72 |
| Do you have a plan how to increase consumption of vegetables in your household diet (Yes)? | 66.95 | 53.78 | 60.16 |
| Do you spend money on purchasing vegetables (yes)? | 83.9 | 90.04 | 87.06 |
| Do you consider your daily diet contains all food groups you need during the day? | 22.88 | 15.14 | 18.89 |
| Do you consider your daily diet contains sufficient nutrients you need during the day (Yes) | 25.85 | 20.72 | 23.2 |

Further, most of the vegetables are bought from the market (90%) or obtained from home garden (39%) (Table 5). About 82% of the farmers consider that their daily diet does not contain all food groups needed per day while 77% believe that their foods do not contain sufficient nutrients. Thus, it is important to conduct training to increase nutrition knowledge among farmers’ households. The nutrition training already started when preparing this report.

**Table 5.** Sources of vegetables consumed.

|  |  |  |  |
| --- | --- | --- | --- |
| Source of the vegetables consumed | Beneficiaries (n=236) | Control  (n= 251) | Total (N=487) |
| Purchased from Market | 83% | 96% | 90% |
| Harvested from homestead garden | 52% | 27% | 39% |
| Harvested from commercial garden | 21% | 12% | 16% |
| Gifted from neighbour/relatives /friends | 21% | 18% | 20% |
| Purchased from other famers | 8% | 7% | 7% |
| Other (vendors) | 0% | 1% | 1% |

## Foods consumed and dietary diversity

The food groups consumed by the households were cereals (100%); spices, condiments and beverages (97%); vegetables (98%); oils and fats (93%); sweets (83%); legumes, nuts and seeds (55%); and fruits (8%) (Fig. 1). Meat-products (i.e. poultry, offal, fish, etc.), eggs, milk, and milk products were rarely consumed by many households. For example, about 1 percent of the households consumed eggs, while less than 10% consumed fish/seafood, milk and milk products. Similar findings were reported in Mbarali and Bahi Districts.

**Figure 1.** Food consumed by households in Karatu (24hour recall).

The average household dietary diversity score (HDDS) was 6.15 which means that on average, households consumed six food groups over the preceding 24-hour recall period (Table 6). Beneficiary’s households (6.33) had higher dietary diversity score (p<0.01) than control households (5.98). HDDS also varied by village.

**Table 6.** Average household dietary diversity scores.

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) |
| HDDS | 6.33 | 5.98\*\*\*a | 6.15 |
| HDDS by village | | | |
| *Intervention villages* | *HDDS* | *Control villages* | *HDDS* |
| Bashay | 7.000 | Dumbechang | 6.400 |
| Buger | 6.667 | Endallah | 5.480 |
| Changarawe | 6.750 | Endamagaw | 6.200 |
| Chemchem | 6.778 | Endashang’wet | 6.240 |
| Endagemu | 7.067 | Getamock | 5.800 |
| Endallah | 8.000 | Kambi ya faru | 5.375 |
| Gylambo | 5.353 | Laja | 5.231 |
| Kainam rhotia | 5.733 | Lositete | 6.667 |
| Kambi ya simba | 6.267 | Makhoromba | 6.083 |
| Khusmay | 5.733 | Tloma | 6.280 |
| Kilima tembo | 5.750 | Total | 5.980 |
| Laghangareri | 7.313 |  | |
| Mbuga nyekundu | 6.818 |
| Ng'aibara | 6.200 |
| Qorong'aida | 6.296 |
| Slahamo | 5.667 |
| Upper kitete | 6.667 |  |  |

## Market channels for vegetables

Households used different market channels to sell their vegetables. The choice of market channel entirely depended on whether the channel is a stable and has a reliable outlet, if it offers higher stable prices, closer to farm or if there exists a trustful relationship between the seller and buyer. Sometimes farmers chose a particular market channel because they had no other alternative or lacked transportation to other markets. Table 7 presents market channels that households used in the last cropping season. Most farmers sold to traders and consumers at the farm gate. Very few sold to restaurants in both, beneficiaries and control villages. Sales to the restaurants are expected to increase as it is one of the project’s objective to train nutritious vegetable recipes to restaurants/kiosks.

**Table 7.** Market channels for vegetables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Vegetables | Beneficiaries (n=236)  Control (n=251) | Market channels (%) | | | | |
| Whole sale | Trader/  Farmgate | Consumer/  Farmgate | Restaurant | Friends/  Neighbors |
| African  Eggplant | Beneficiaries | 45 | 0 | 0 | 0 | 0 |
| Control | 100 | 100 | 100 | 0 | 0 |
| Ethiopian  Mustard | Beneficiaries | 59 | 61 | 50 | 7 | 20 |
| Control | 59 | 64 | 33 | 0 | 0 |
| African  Nightshade | Beneficiaries | 64 | 69 | 69 | 11 | 33 |
| Control | 24 | 45 | 0 | 0 | 0 |
| Tomato | Beneficiaries | 96 | 100 | 100 | 15 | 44 |
| Control | 100 | 100 | 100 | 0 | 0 |
| Onions | Beneficiaries | 100 | 29 | 86 | 14 | 41 |
| Control | 100 | 100 | 88 | 0 | 0 |
| Pumpkin leaves | Beneficiaries | 100 | 100 | 100 | 17 | 52 |
| Control | 100 | 100 | 100 | 0 | 0 |

## Training, Extension services and credit

Overall, 17% of farmers acknowledged to have received horticulture training in the last cropping season. More than 50% of farmers reported to have received training from Research, Community and Organizational Development Associates (RECODA). Ninety four percent received training on agricultural production while 48% were trained on nutrition and 36% received training on business and farm management. Only 9% accredited to have received financial (credit) sources training.

Training on agricultural production covered various techniques as presented in Table 7. More project beneficiaries acknowledged to have received training than the non-project beneficiaries (Table 8).

**Table 8**. Trained agricultural techniques

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Overall (N=487) |
| Kind of agricultural techniques were you/or your family members trained | | | |
| 1=Use of improved seeds | 33% | 4% | 18% |
| 2=Use of new food crops | 20% | 2% | 11% |
| 3=Proper use of fertilizer | 32% | 3% | 17% |
| 4=Weed control (herbicides, weeding) | 26% | 2% | 14% |
| 5=Conservation agriculture (zero /minimal tillage, composting) | 25% | 2% | 13% |
| 6=Pest management practices (pesticides) | 26% | 3% | 14% |
| 7=Improved post-harvest techniques | 22% | 2% | 12% |
| 8=Improved water management | 25% | 2% | 13% |

## Challenges of vegetable production

**Figure 2.** Challenges of vegetable production.

# Conclusion and recommendation

## Conclusion

Baseline results showed that farmers still lack knowledge about the nutritional contents of vegetables and their health benefits. Most households would like to increase vegetable consumption and they indicated to have plans of how to increase consumption of vegetables by family members. The main foods consumed by the households were cereals, spices, condiments and beverages, vegetables, oils and fats, sweets, legumes, nuts and seeds and fruits. Meat products (i.e. poultry, offal, fish, etc.), eggs, milk and milk products were rarely consumed by many households. The average household dietary diversity score (HDDS) was 6.15 which means that on average, households consumed six food groups over the preceding 24-hours. Intervention households had higher dietary diversity score (p<0.01) than control households. More than 50% of what was consumed in the household was purchased.

Most farmers sold vegetables at farmgate to traders or consumers. It is surprising that very few sold to restaurants or kiosks which are many in Karatu district as it is a business center for tourism activities. Farmers mentioned the lack of a reliable market, extreme drought conditions and pest and diseases to pose the most threats in the production of vegetables.

## Recommendations

Based on the findings of this baseline farm household survey, the following recommendations can be made to the project stakeholders and strategic development partners:

* Farmers are willing to learn and engage in vegetable farming for improved food and nutrition security. Providing them with GAP education will improve the necessary knowledge and skills to engage in vegetable farming.
* Training programs should also provide information on the improved seeds; where they can be purchased and how to best store them.
* To create awareness on the health benefits of vegetable consumption, trainings should be conducted on the nutritive value of vegetables and ways to prepare vegetables that will preserve the nutritive contents.
* The use of inorganic fertilizer and pesticides for vegetables should be discouraged among farmers and a shift to organic manure should be promoted because it is environmentally friendly.
* Farmers should also be provided with practical skills and knowledge on ways of harnessing rainwater and to use that for irrigation of vegetables as most areas are dry.
* Vegetable farmers should also be trained on the improved traditional vegetable processing and storage techniques to reduce post-harvest losses and for longer vegetable shelf life.

# Appendices

## Appendix 1. References

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## Appendix 2. Utilization of most common vegetables

**Table 3 A.** Ethiopian Mustard.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (B=C) t-test/ chi -test |
| Yield (Kg) | 464.1 | 314.2 | 386.8 | 0.508 |
| Home consumption (kg) | 33.721 | 15.49 | 24.325 | 0.002 |
| Distributed to neighbors (kg) | 31.3 | 16.8 | 23.8 | 0.060 |
| Post-harvest loss (kg) | 20.469 | 5.4 | 12.698 | 0.296 |
| Quantity sold (kg) | 378.7 | 276.5 | 326.0 | 0.647 |
| Market participation (% sold) | 82% | 88% | 84% |  |
| Post-harvest loss (% lost) | 4% | 2% | 3% |  |

**Table 3B.** African nightshade.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (B=C) t-test/ chi -test |
| Yield (Kg) | 258.9 | 203.9 | 230.6 | 0.769 |
| Home consumption (kg) | 20.734 | 34.60 | 27.878 | 0.647 |
| Distributed to neighbours (kg) | 21.249 | 8.260 | 14.554 | 0.046 |
| Post-harvest loss (kg) | 6.270 | 0.3 | 3.179 | 0.187 |
| Quantity sold (kg) | 210.676 | 160.757 | 184.948 | 0.784 |
| Market participation (% sold) | 81% | 79% | 80% |  |
| Post-harvest loss (% lost) | 2% | 0% | 1% |  |

**Table 3C.** Onions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (B=C) t-test/ chi -test |
| Yield (Kg) | 449.8 | 825.2 | 643.3 | 0.186 |
| Home consumption (kg) | 2.861 | 15.107 | 9.172 | 0.001 |
| Distributed to neighbours (kg) | 1.749 | 25.415 | 13.947 | 0.058 |
| Post-harvest loss (kg) | 13.641 | 34.9 | 24.585 | 0.346 |
| Quantity sold (kg) | 431.589 | 749.795 | 595.592 | 0.235 |
| Market participation (% sold) | 96% | 91% | 93% |  |
| Post-harvest loss (% lost) | 3% | 4% | 4% |  |

**Table 3D.** Tomato

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (B=C) t-test |
| Yield (Kg) | 79.1 | 105.2 | 92.6 | 0.678 |
| Home consumption (kg) | 18.405 | 57.25 | 38.426 | 0.477 |
| Distributed to neighbours (kg) | 9.788 | 6.944 | 8.322 | 0.549 |
| Post-harvest loss (kg) | 1.385 | 2.6 | 1.991 | 0.391 |
| Quantity sold (kg) | 49.521 | 38.482 | 43.832 | 0.639 |
| Market participation (% sold) | 63% | 37% | 47% |  |
| Post-harvest loss (% lost) | 2% | 2% | 2% |  |

**Table 3E.** Chinese cabbage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Beneficiaries (n=236) | Control (n= 251) | Total (N=487) | (T=C) t-test/ chi -test |
| Yield (Kg) | 150.451 | 269.035 | 211.569 | 0.230 |
| Home consumption (kg) | 17.682 | 96.102 | 58.100 | 0.207 |
| Distributed to neighbors (kg) | 14.313 | 14.571 | 14.446 | 0.966 |
| Post-harvest loss (kg) | 4.590 | 4.986 | 4.794 | 0.913 |
| Quantity sold (kg) | 113.9 | 153.4 | 134.2 | 0.582 |
| Market participation (% sold) | 76% | 57% | 63% |  |
| Post-harvest loss (% lost) | 3% | 2% | 2% |  |